Lean Construction Institute

Provider Number H561

Lean Design Forum P2SL/AIA/LCI 2016-Day One

P2SLDF20161

January 28, 2016

7 LU/HSW Credit(s) earned on completion of this course will be reported to AIA CES for AIA members. Certificates of Completion for both AIA members and non-AIA members are available upon request.

This course is registered with AIA CES for continuing professional education. As such, it does not include content that may be deemed or construed to be an approval or endorsement by the AIA of any material of construction or any method or manner of handling, using, distributing, or dealing in any material or product.

Questions related to specific materials, methods, and services will be addressed at the conclusion of this presentation.

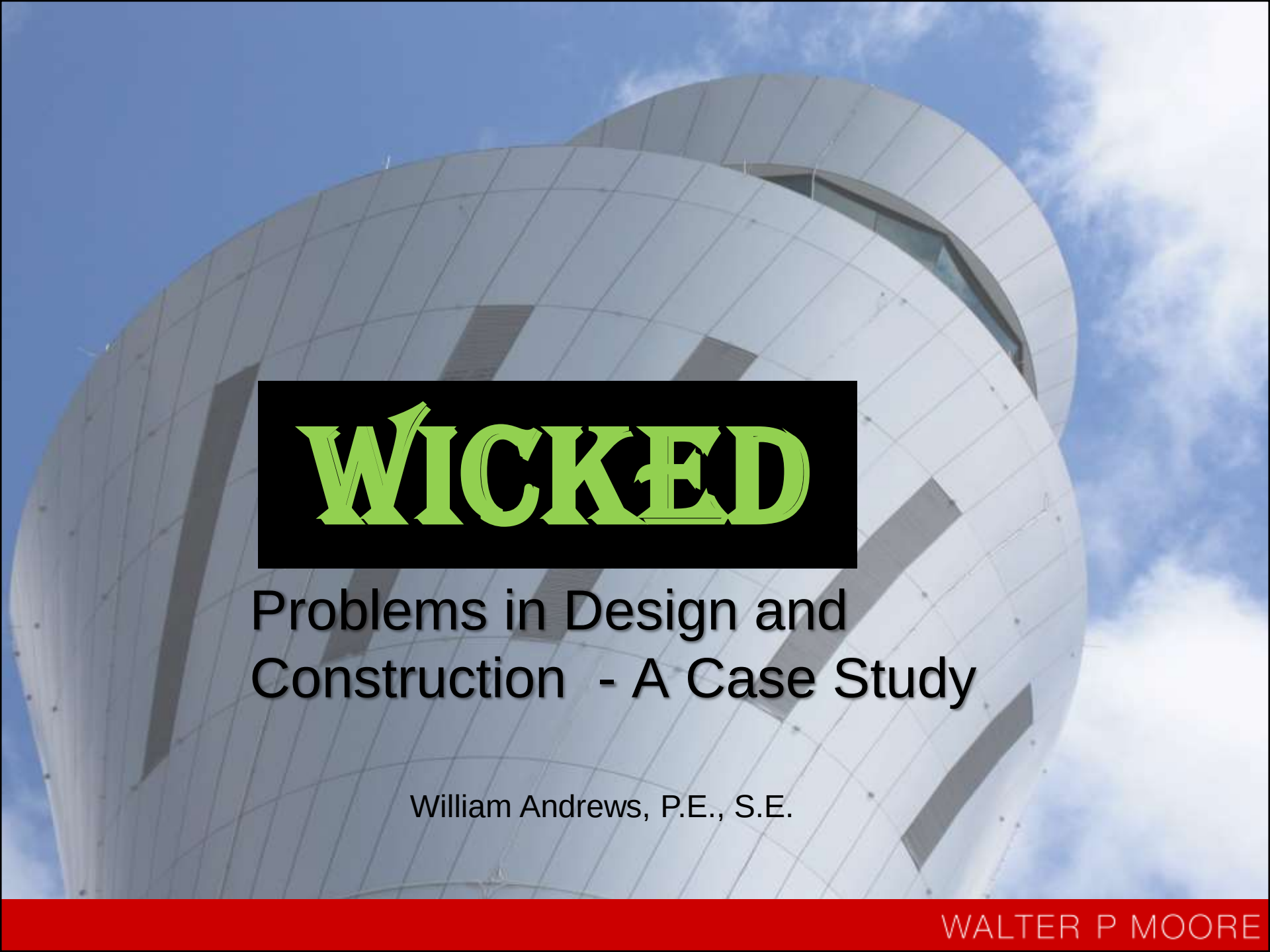
Course Description

One day instruction and discussion devoted to Lean design in a variety of areas including cost estimates, conceptual estimating, project management, and problem solving. In-depth discussion and sharing of experiences will spotlight phases of the Lean journey. Increasing accuracy of conceptual estimates will be explained. Architects from different areas of practice will explain, and lead analysis of, how experience with Lean project management has changed the way they design. As a follow-up to the 2015 P2SL/AIA/LCI Design Forum presentations on problem framing, case studies of "wicked problems" will be shared and discussed.

Learning Objectives

At the end of this presentation, participants will be able to:

1. Identify design challenges which make a building project a “wicked problem”.
2. Understand how framing helps define and solve "wicked problems".
3. Consider application of Lean practices to tackle “wicked problems” in the design process.



WICKED

Problems in Design and Construction - A Case Study

William Andrews, P.E., S.E.

ASCENT 2020

SFO BUILDING FOR THE FUTURE

San Francisco International Airport Air Traffic Control Tower

FENTRESS ARCHITECTS

HP

SFO San Francisco International Airport

Federal Aviation Administration

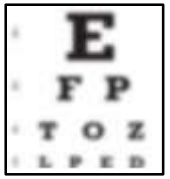
WALTER P MOORE

Wicked Projects

Analytic Process

Synthetic Process

- *Ambiguous*



- *Uncertain*

- *Complex*

- *Volatile*

Understanding the *Existing Story*

Developing the *New Story*

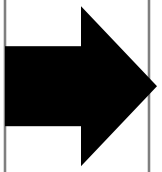
Project Teams

BRIDGING DOCUMENTS TEAM

HNTB: *Architecture, Structural, Civil, Electrical, Mechanical*

Rutherford+Chekene: *Seismic-structural design, geotechnical, and ground motions*

Weidlinger: *Blast design, wind design*



DESIGN-BUILD TEAM

Hensel Phelps Construction: *Contractor*

Fentress Architects: *Architecture*

Walter P Moore: *Structural & Blast*

Bello & Associates

URS: *Geotechnical, Civil, Mechanical, Plumbing, Electrical*

Project Reviewers

Structural Peer Review Team

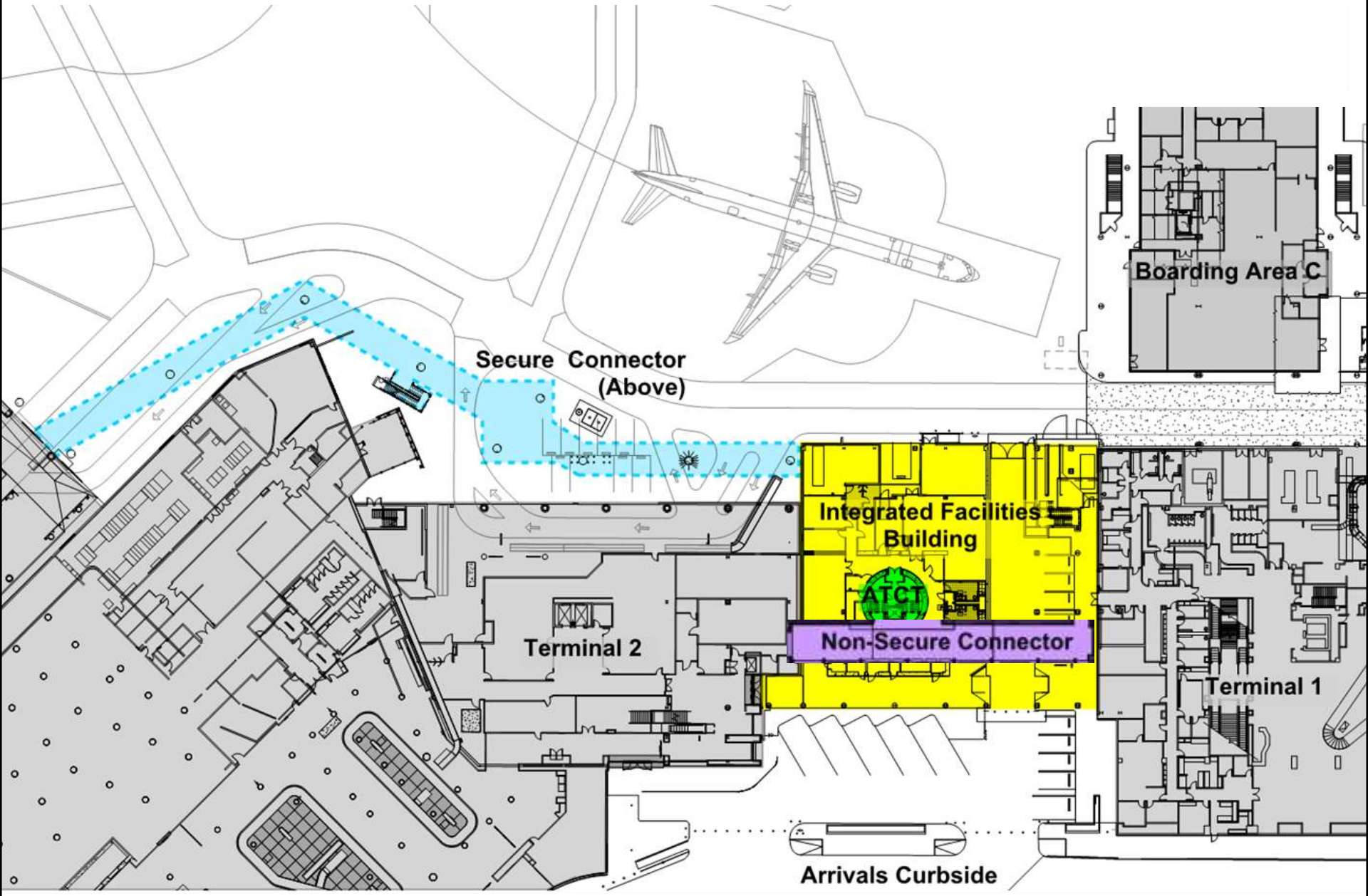
SFO Bureau of Design and Construction

Federal Aviation Administration

SFO Building Inspection and Code Enforcement (BICE)

San Francisco Fire Department

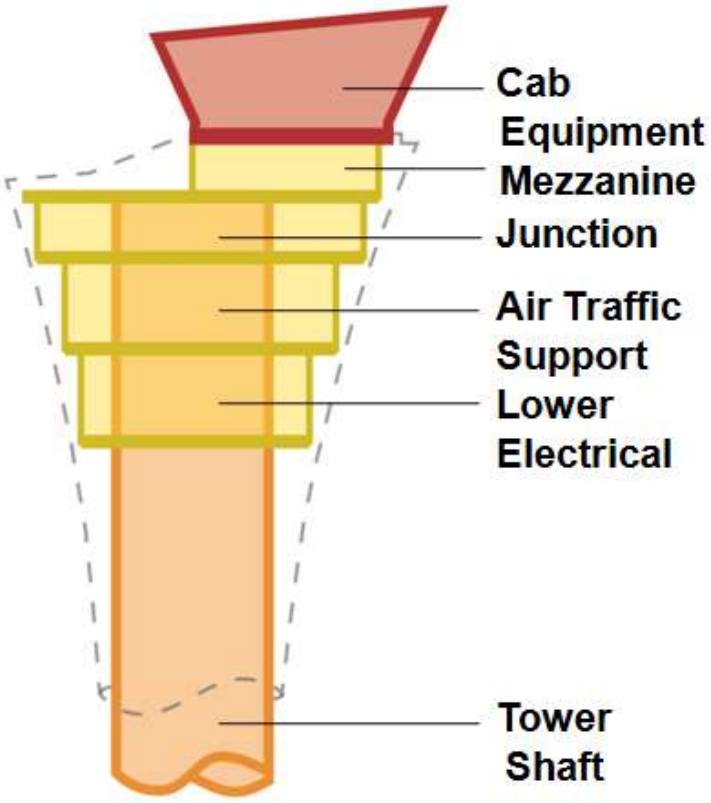
Other SFO Stakeholders

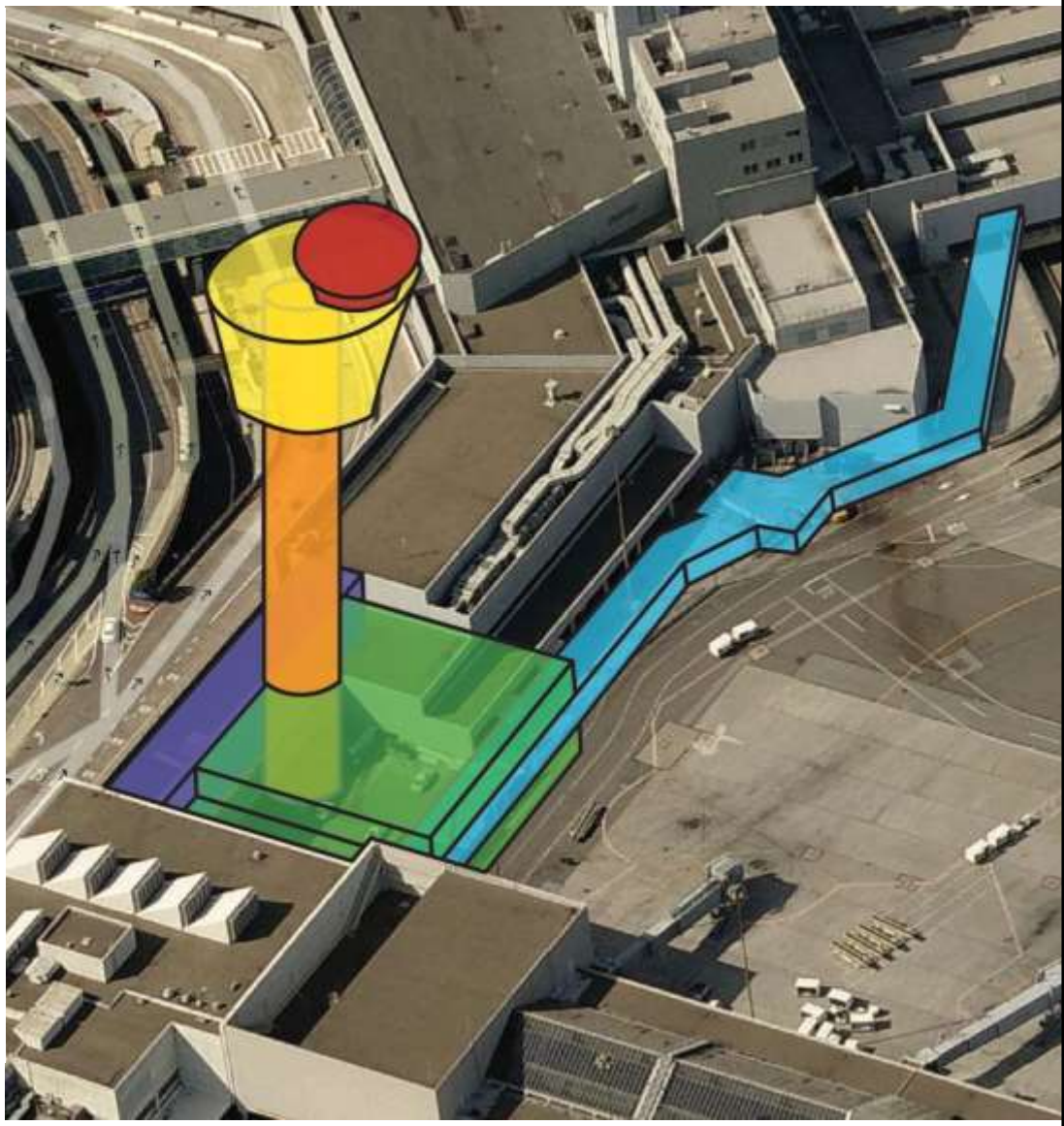

Boarding Area C
Secure Connector
(Above)
Integrated Facilities
Building
ATCT
Non-Secure Connector
Terminal 2
Terminal 1
Arrivals Curbside

Project Description

https://www.youtube.com/watch?v=X4h7Y0YWurA

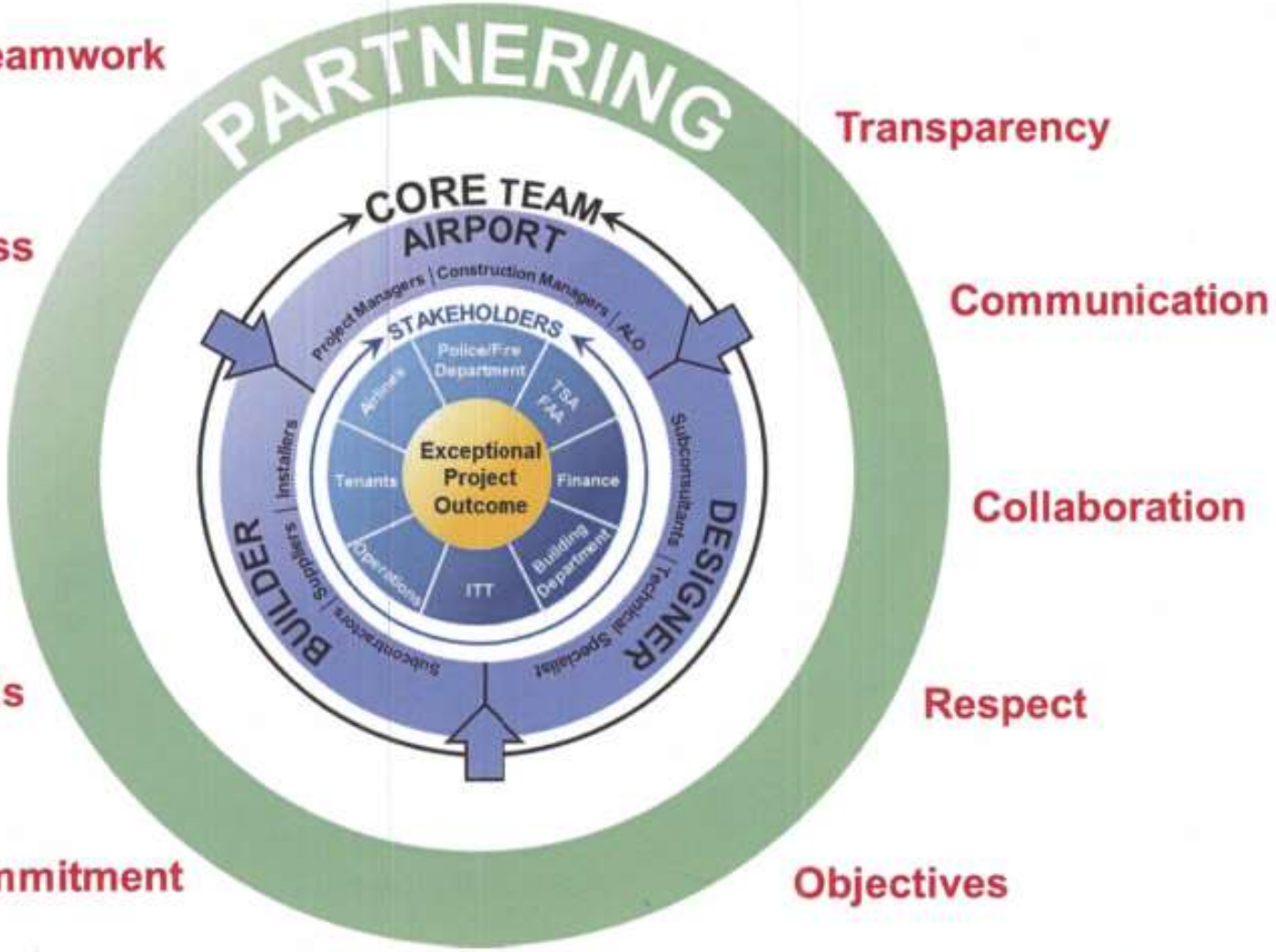
Design Concept





SFO San Francisco International Airport

Delivering Exceptional Projects - Our Guiding Principles



Project “Firsts”

- *First* ATCT delivered with the local airport using Design-Build delivery
- *First* ATCT to employ PBD with vertical post-tensioning
- *Tallest* vertical post- tensioned, self-righting tower in U.S.
- *First* ATCT to used tuned mass dampers for air controller comfort
- *First* ATCT with 235 degree unobstructed, column free view

Other Significant Features

- (*Early*) 45% Design Bridging Documents
- Fast Track design & construction within an operational airport
- Highly visible project
- Multiple authorities having jurisdiction and codes
- Multiple stakeholders
- 13 exterior cladding systems
- 18 bid packages
- Bay Mud site

		Ambiguous	Complex	Uncertain	Volatile
Significant Project Challenges	45% Bridging Documents				
	Advanced Engineering				
	Multiple AHJ's				
	Peer Review				
	New Technology/ Innovation				
	Fast Track Delivery				
	Site Logistics				

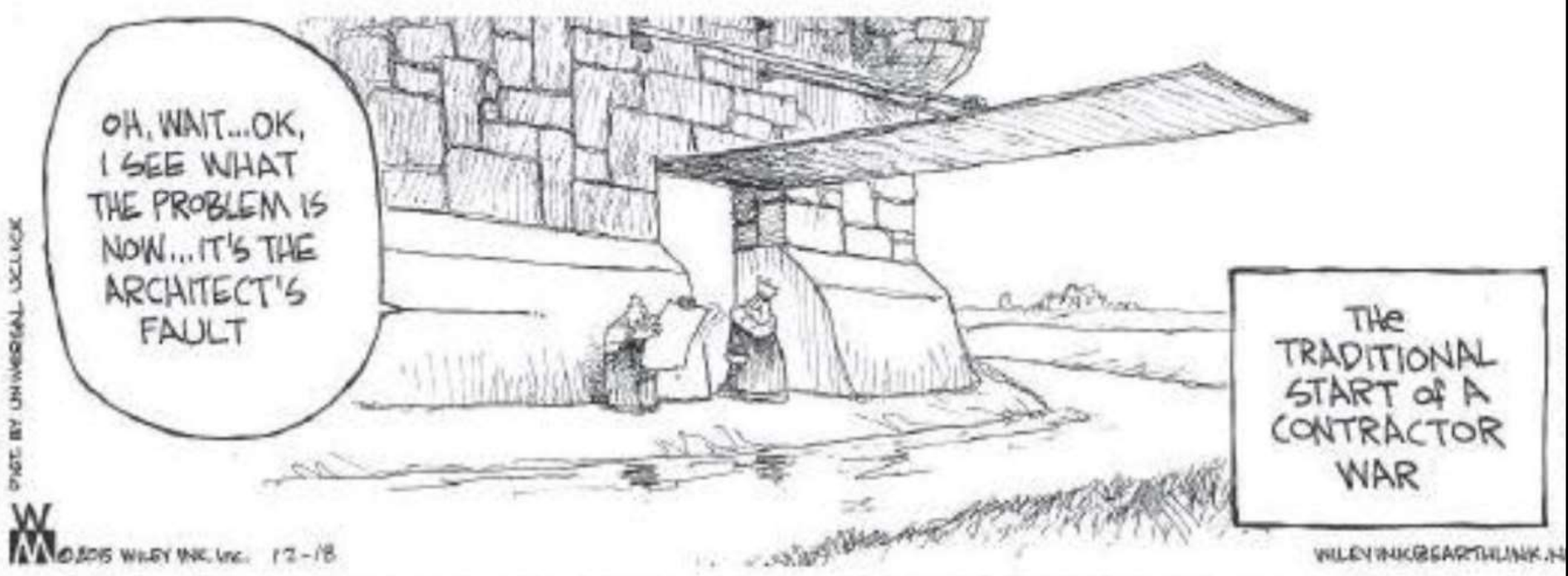
LESSONS LEARNED



Lesson #1

Trust Across Your Team

~~Blame Game~~

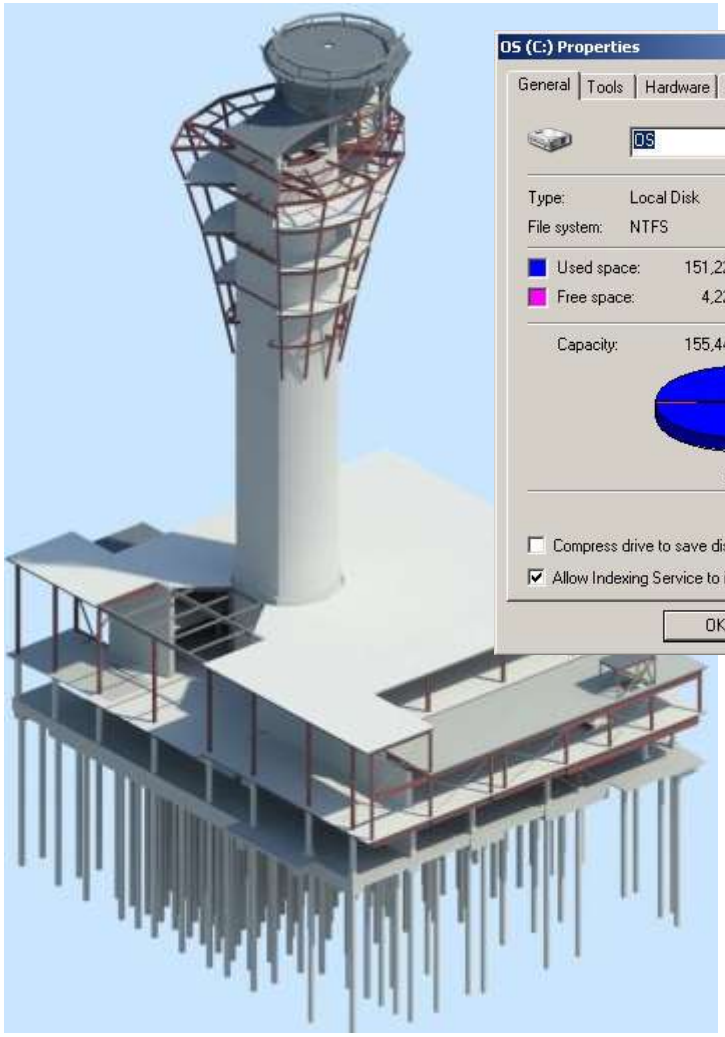

NON SEQUITUR | Wiley
OH, WAIT...OK, I SEE WHAT THE PROBLEM IS NOW...IT'S THE ARCHITECT'S FAULT
THE TRADITIONAL START of A CONTRACTOR WAR
©2015 WILEY INK, Inc. 12-18
WILEYINK@EARTHLINK.N

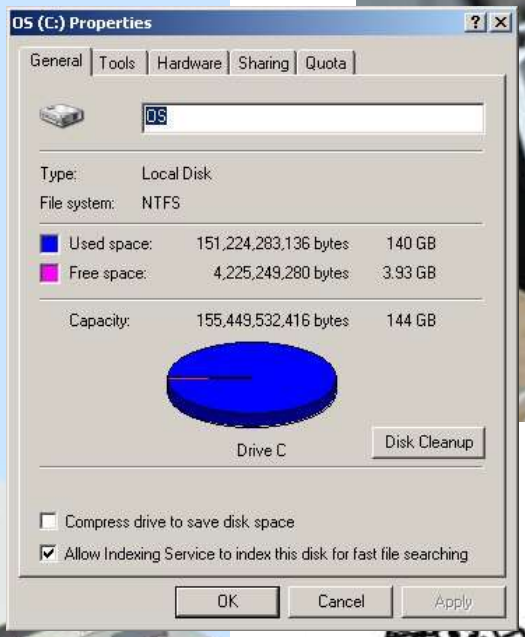



Lesson #2

Pull the Andon Cord

ANALYSIS





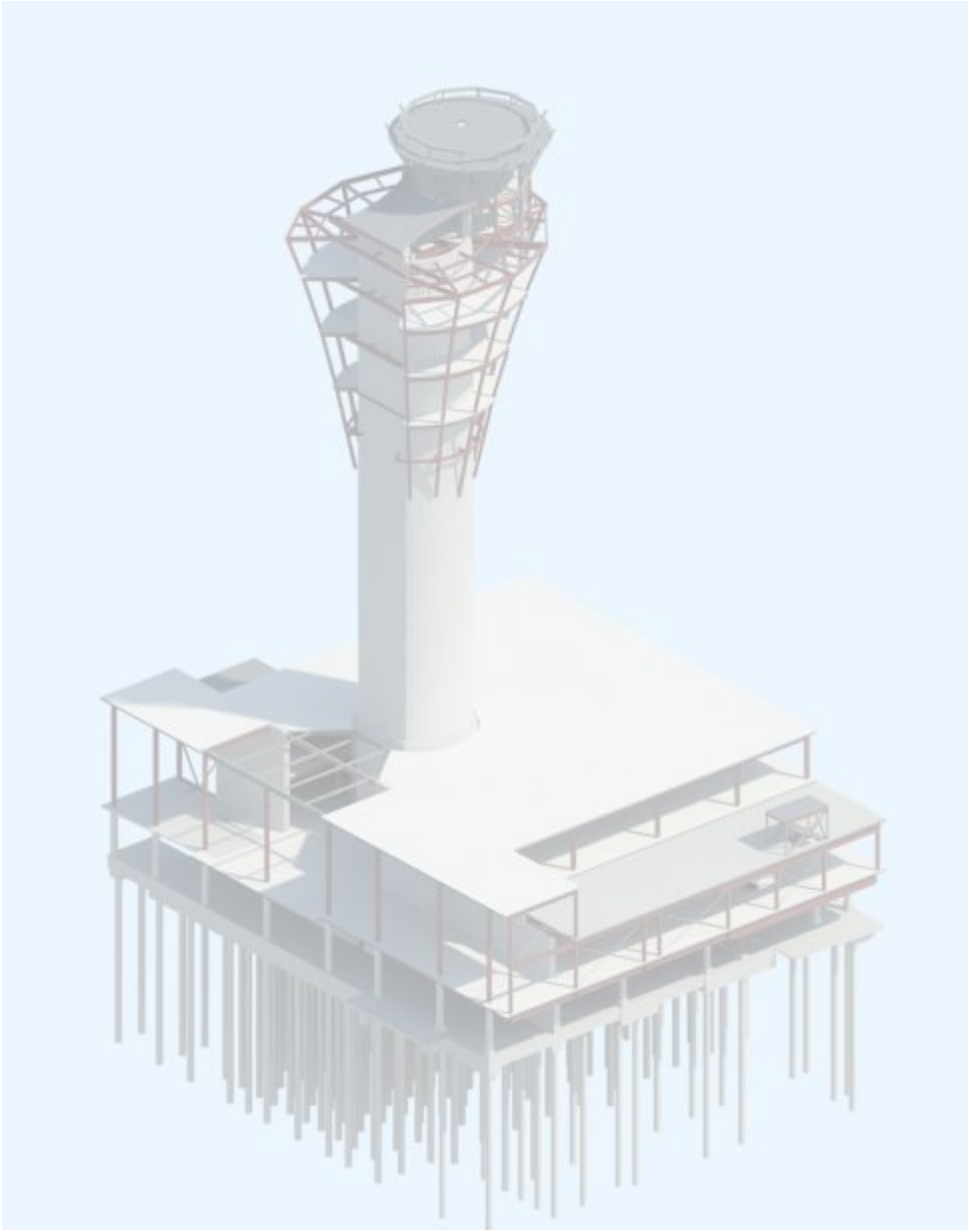
"Yes, I would recommend more analysis."



Lesson #3

Dig Deeply

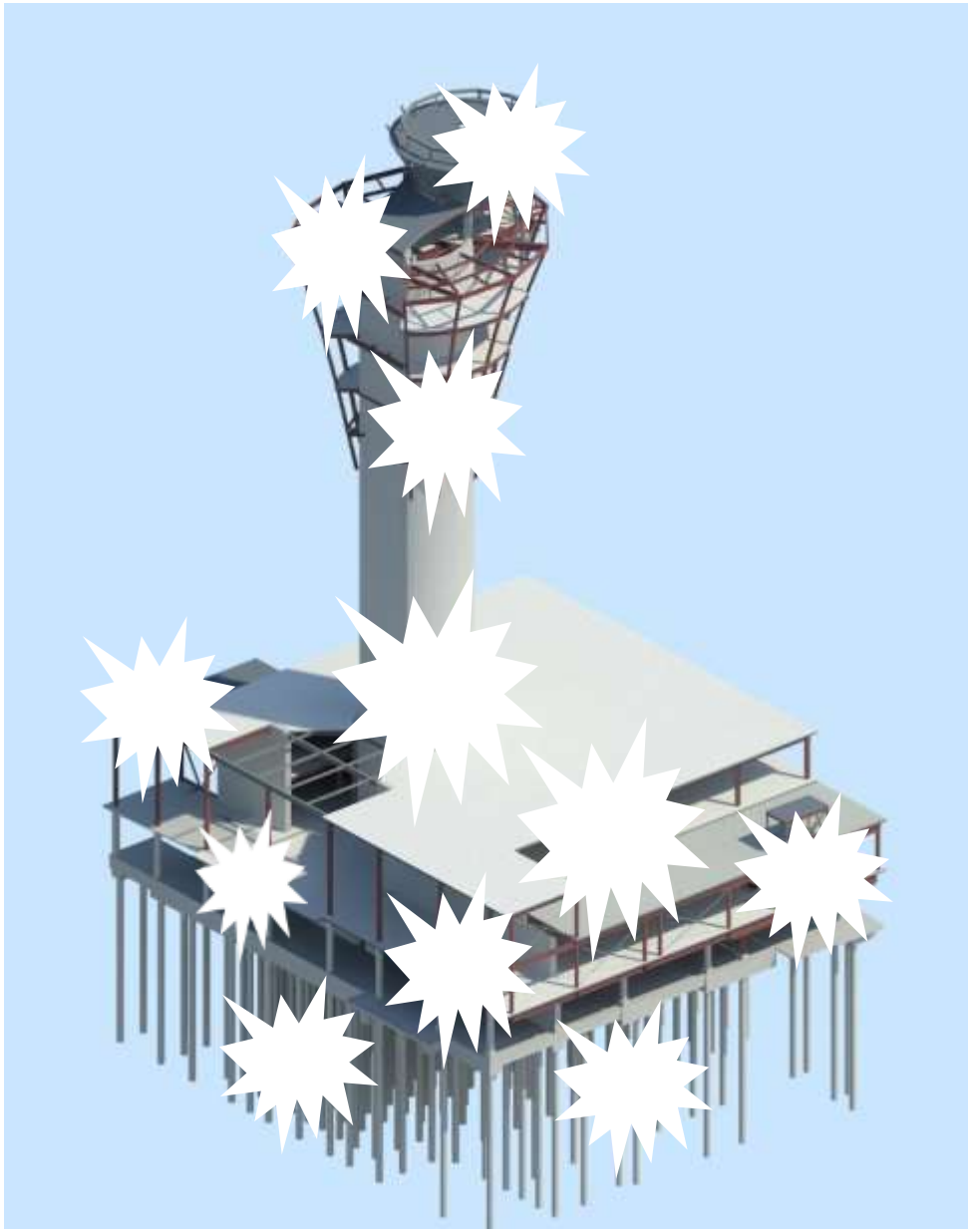
45% Design ??



45%

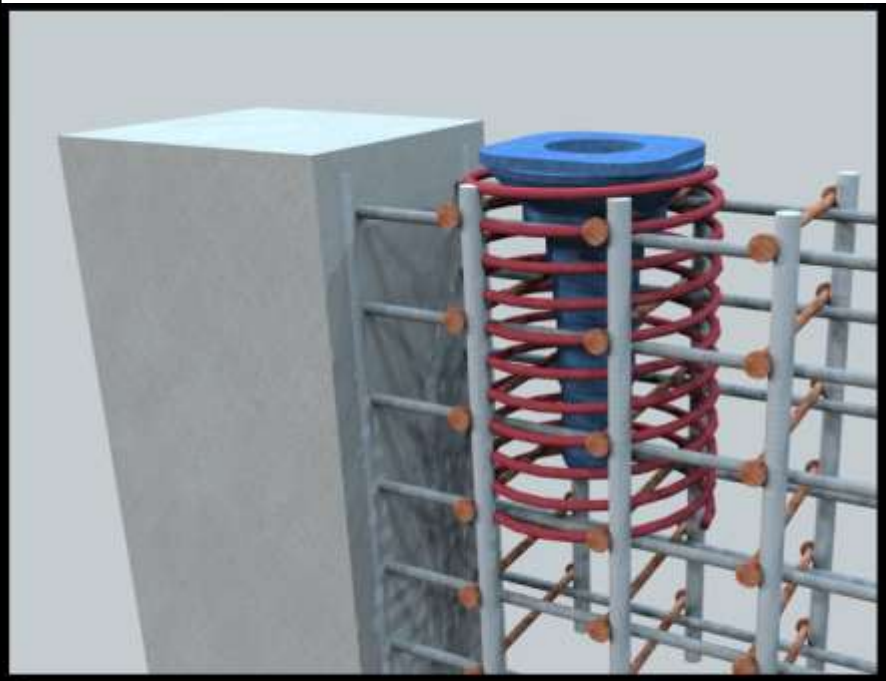
Design

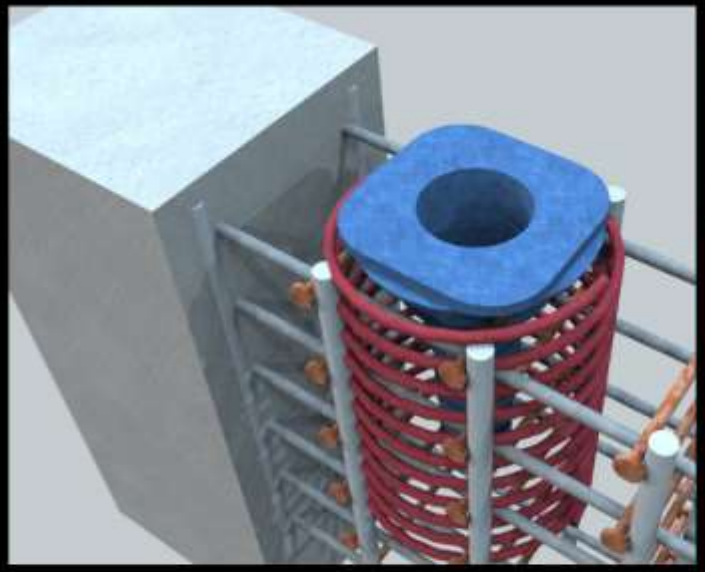
??




Lesson #4

Mockups and Simulations

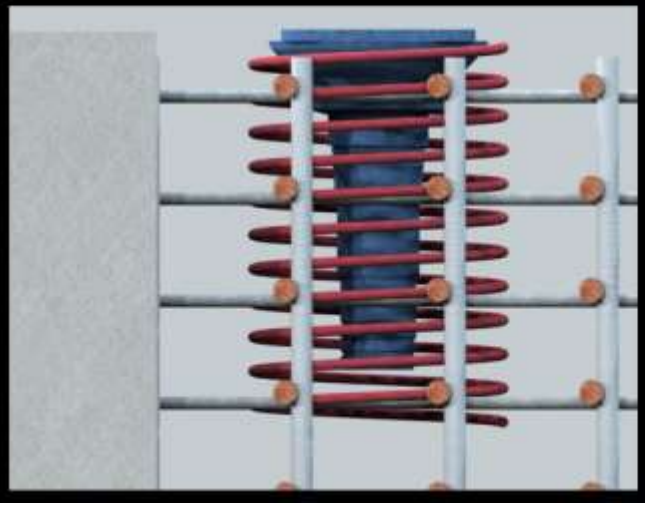


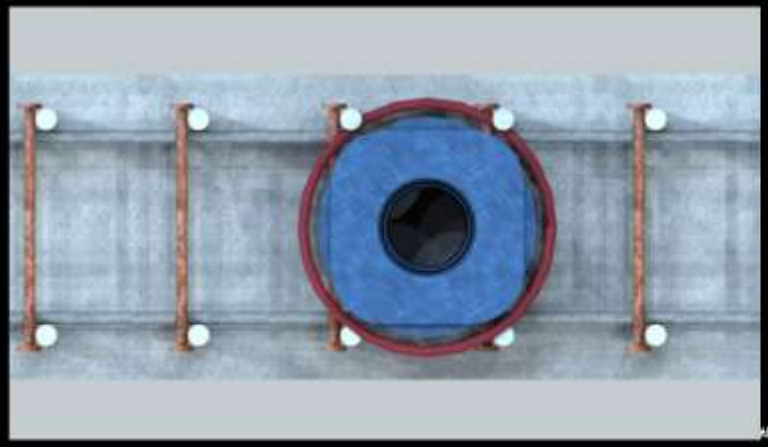


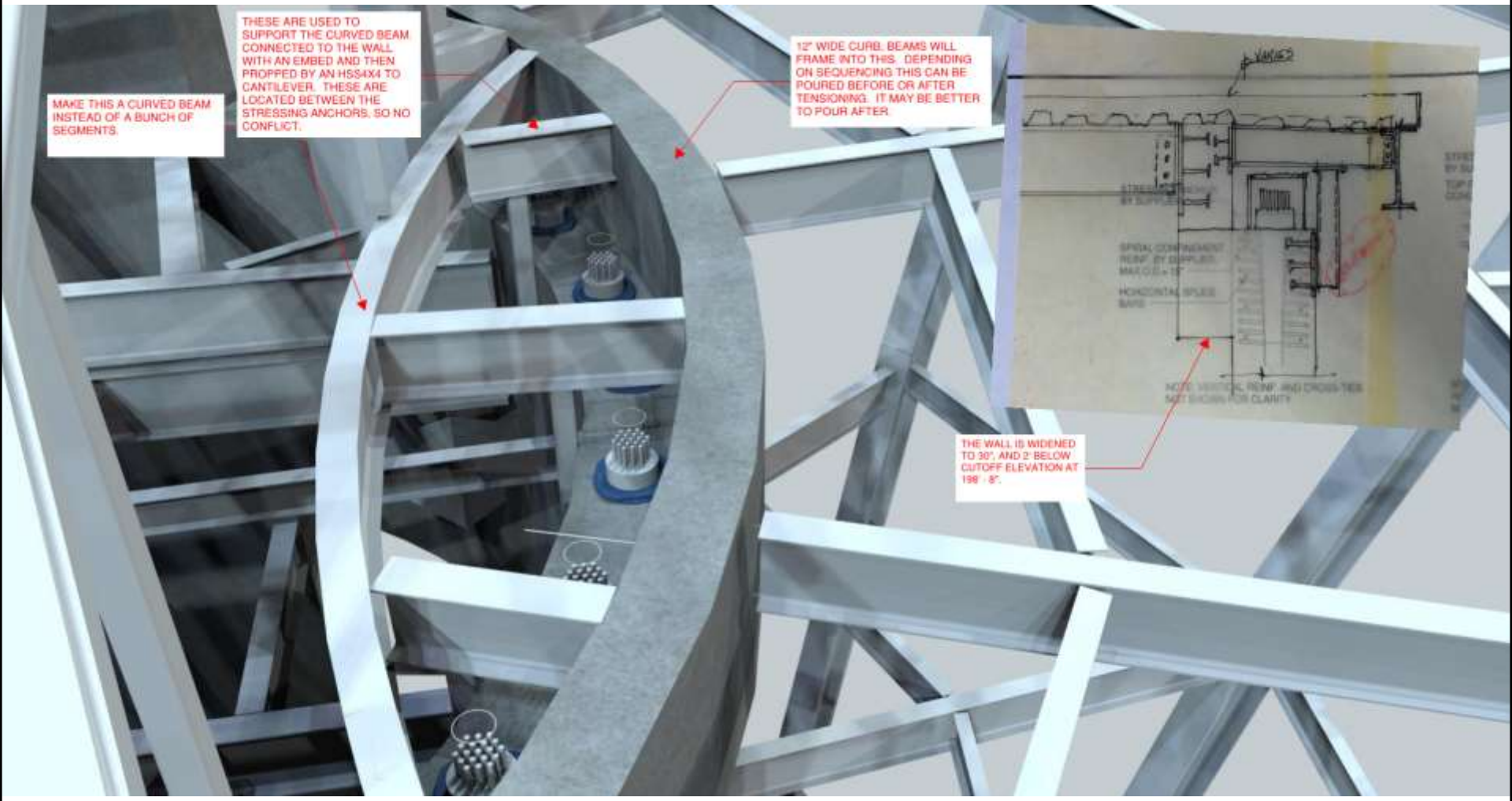
Vertical reinforcement is #10 @ 9", horizontal reinforcement is #6 @ 6", #5 HRC 555 cross-ties at 6" spacing, wall thickness = 18", clear cover = 2" for exposed wall.

The anchor appears feasible, though the reinforcement in the immediate area will need to be adjusted and it appears that the horizontal bars will run through the confinement area. This should not be a problem. We will also want to add some bursting steel at 9" below the anchor. This will just be additional cross-ties.

Basis of design is VSL ECI 6-19 Stressing Anchorage, 15" diameter out to out spiral reinforcement, Pu - 1,069 kips






MAKE THIS A CURVED BEAM INSTEAD OF A BUNCH OF SEGMENTS.
THESE ARE USED TO SUPPORT THE CURVED BEAM CONNECTED TO THE WALL WITH AN EMBED AND THEN PROPPED BY AN HSS4X4 TO CANTILEVER. THESE ARE LOCATED BETWEEN THE STRESSING ANCHORS, SO NO CONFLICT.
12" WIDE CURB. BEAMS WILL FRAME INTO THIS. DEPENDING ON SEQUENCING THIS CAN BE POURED BEFORE OR AFTER TENSIONING. IT MAY BE BETTER TO POUR AFTER.
THE WALL IS WIDENED TO 30", AND 2' BELOW CUTOFF ELEVATION AT 198' - 8".

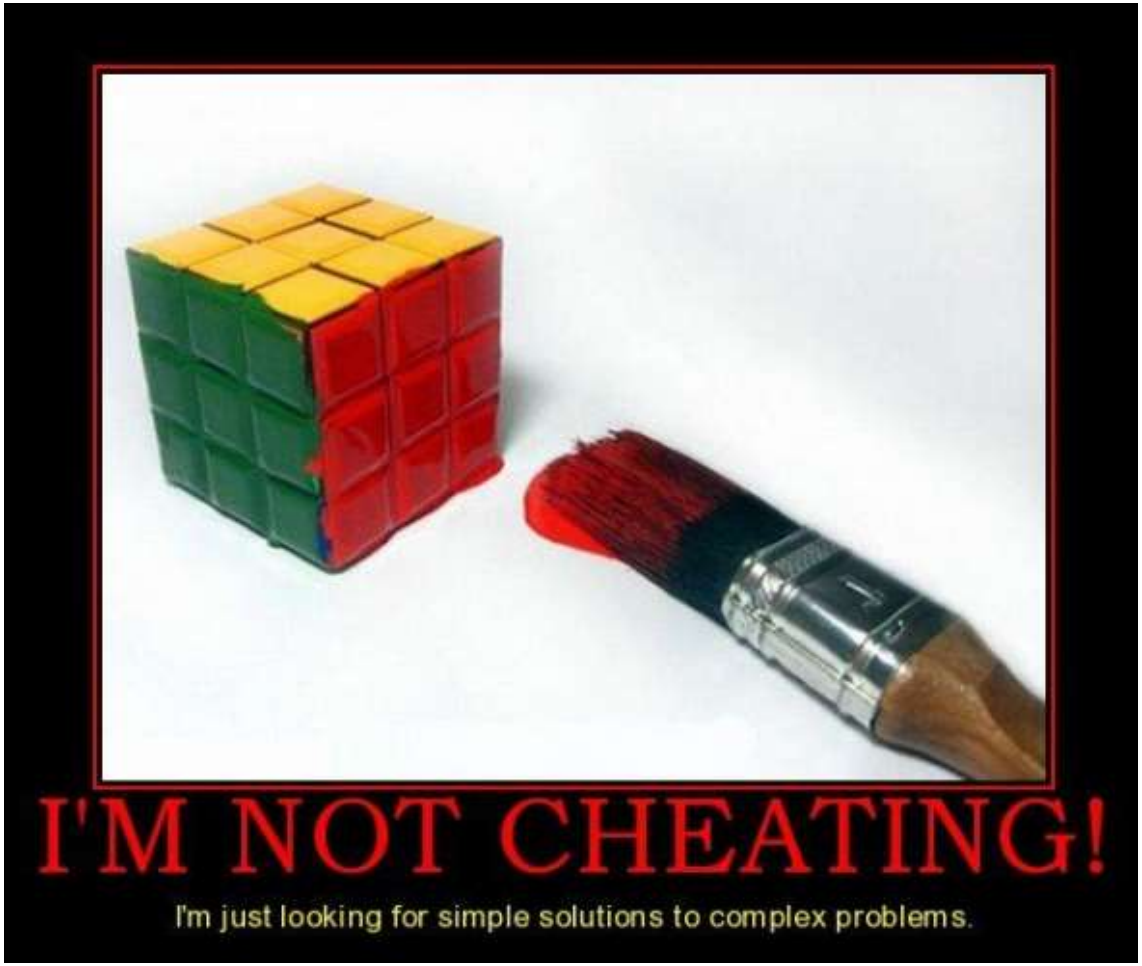
Lesson #5

Recalibrate Work Plans Frequently

Flow?

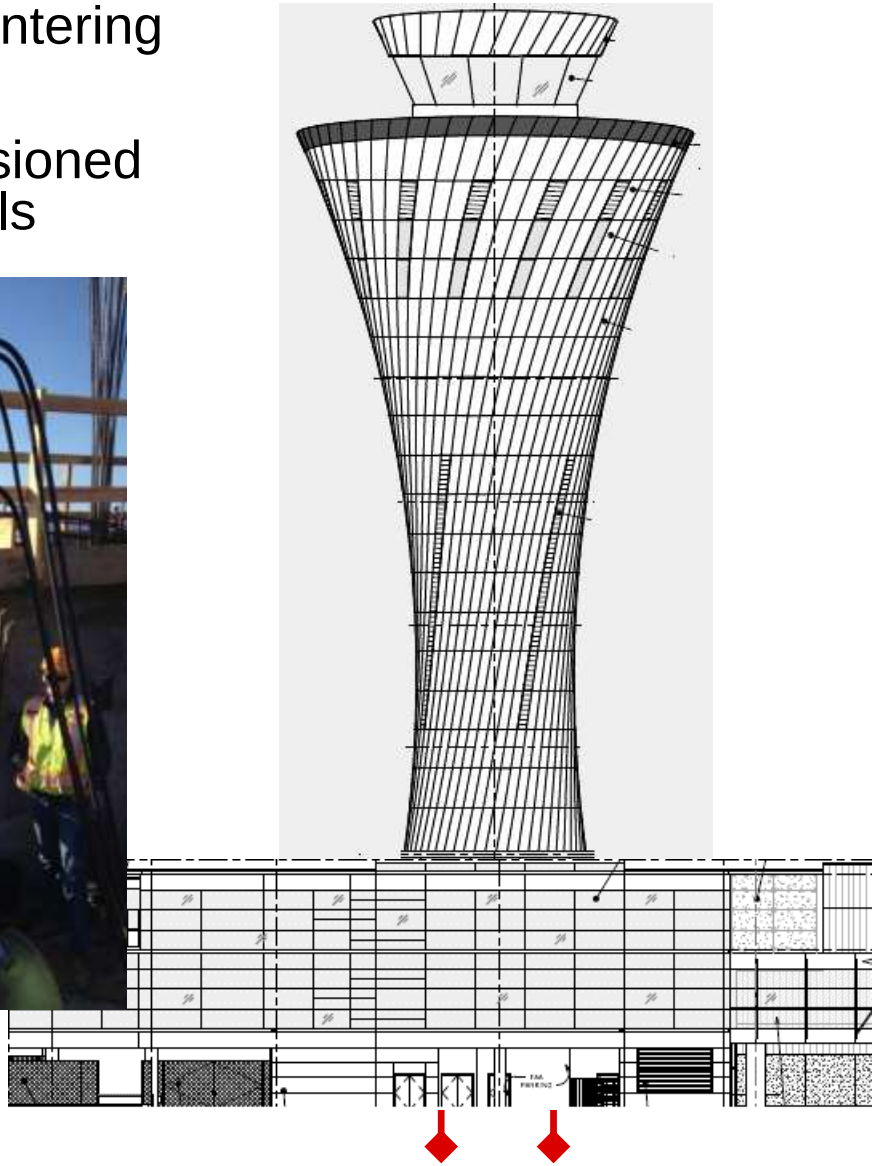
Lesson #6

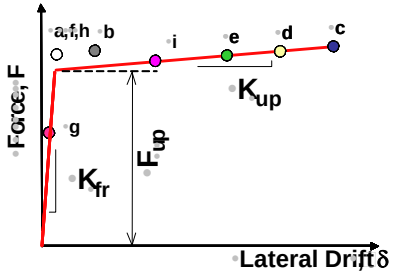
Frame the Complex In Simple Forms



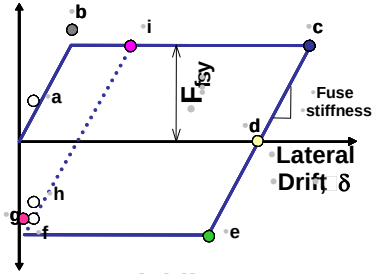
Technical Complexity

- Rocking, Self-Centering System
- Vertical post-tensioned concrete core walls

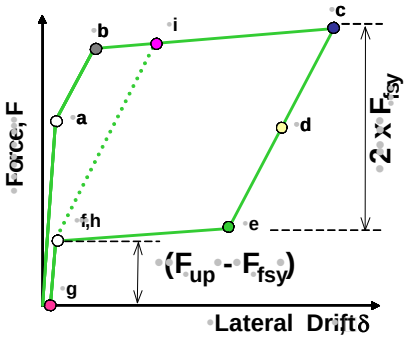




PT and Elastic System

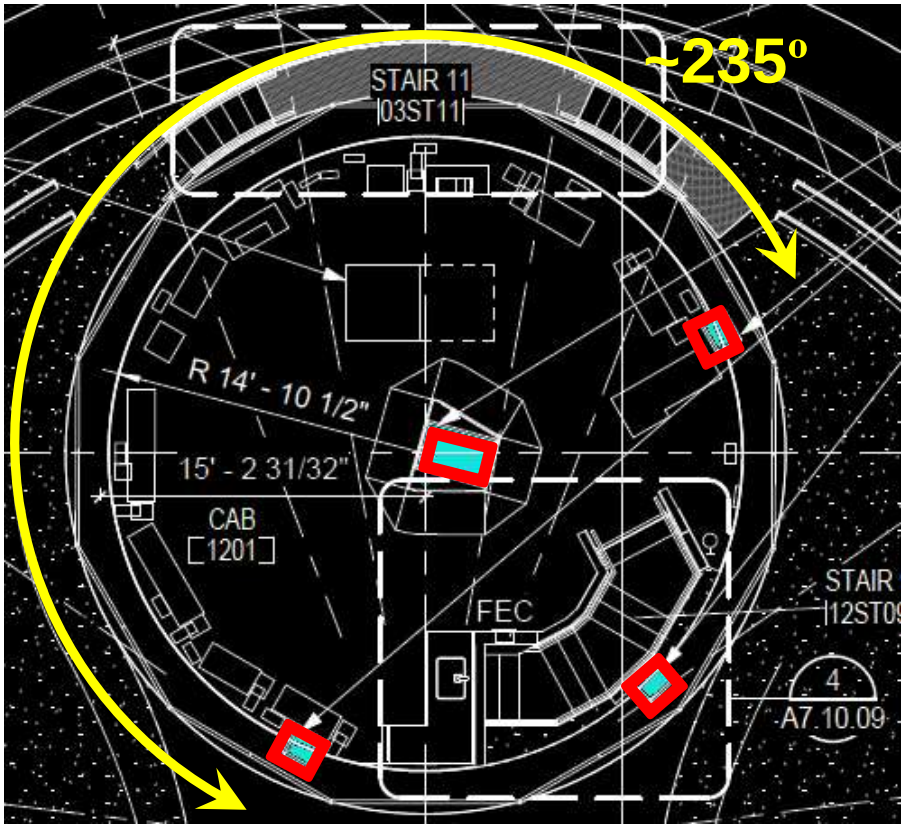


Yielding Component



Combined Response

DESIGN INNOVATION: A CLEAR VIEW WITHOUT COLUMNS



Questions?

This concludes The American Institute of Architects
Continuing Education Systems Course

Lean Construction Institute  **info@leanconstruction.org**